DOCUMENT RESUME

ED 229 902 EC 151 699

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TITLE Children with Spina Bifida: Why Do They Fail in School?
PUB DATE Aug 82
NOTE 10p.; Paper presented at the Annual Convention of the American Psychological Association (90th, Washington, DC, August 23-27, 1982). Print is marginally legible.
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement; *Congenital Impairments; Elementary Secondary Education; *Failure; Socioeconomic Status; Student Evaluation
IDENTIFIERS *Spina Bifida

ABSTRACT

Thirty-eight children with spina bifida, a congenital defect involving the nervous system, were tested for verbal and performance ability and freedom from distractibility on the Wechsler Intelligence Scale for Children-Revised. Achievement on the Wide Range Achievement Test was also measured, and medical and socioeconomic information obtained. Multiple regression analyses were conducted to determine the relative contribution of social, intellectual, distractibility, and biological factors to achievement. Results revealed that socioeconomic status, verbal and performance intellect, and freedom from distractibility were generally related to achievement, while hydrocephalus and lesion level were not. Findings suggested the need for assessment to be thorough and comprehensive. (Author/CL)

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Children with Spina Bifida: Why do they fail in school?

Spina bifida is a congenital defect involving the nervous system, which results in a defective bony encasement of the spinal cord, and a sac-like mass containing meninges and/or parts of the spinal cord, that may protrude at the site of the spina bifida. Paralysis of the lower extremities, lack of bowel and bladder control, and delayed intellectual growth are frequent concomitants. The incidence of spina bifida is approximately 1 to 2.5 per 1000 babies born in the United States (Macmahon, Pugh, & Ingalls, 1953). In London, spina bifida children comprised the largest group of physically handicapped children enrolled in special schools after the cerebral palsied. Eight out of ten children with spina bifida also have hydrocephalus, head enlargement due to excessive accumulation of cerebrospinal fluid, which necessitates shunting and further inhibits intellectual growth.

Several studies of English children with Spina bifida have documented the intellectual concomitants of this anomaly. As a group, spina bifida children have low average intelligence, but complications of hydrocephalus tend to lower IQ further when compared to those without hydrocephalus. (Bodell-Ribera, et al, 1966; Diller, 1969; Lawrence & Tew, 1971; Tew & Lawrence, 1975)

In addition to lowered intellectual potential, these children frequently have specific handicaps that interfere with learning, beyond the extent expected by an overall estimate of their IQ. One of the most commonly reported handicaps is delayed perceptual-motor functioning involving eye-hand coordination and tactile-perception, as well as figure-ground perception.

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(Bodell-Ribera, et al, 1966; Miller & Sethi, 1971; Sella, Foltz, & Shurtleff, 1966; Spain, 1974). This deficit is probably related to the finding that performance IQs are significantly delayed relative to verbal IQs in children who have hydrocephalus in addition to spina bifida. A second commonly found intellectual handicap is short attention span, distractibility, and difficulty concentrating. (Hagburg, 1962).

In addition to intellectual deficits, these children experience frequent hospitalization for orthopedic or urinary tract surgery, physical therapy, and treatment of infections; hence, they are likely to be delayed in their school achievement because of absence. Yet, despite the documented intellectual deficits knowledge of their educational attainments is lacking. In 1971, Tew and Laurence remarked that there were few studies of the educational abilities of spina bifida children and this observation is still appropriate today. Diller (1969) found that these children have a lag of 18 months in reading and 36 months in arithmetic behind their chronological age; however, it is not known whether this lag is primarily due to overall low intelligence or to selected deficits in visual motor development and attention span.

In one of the few studies designed to answer this question, Tew and Laurence used a multiple regression equation to compare observed achievement with that achievement expected on the basis of IQ. They found that children in normal school settings were reading at the level expected on the basis of their IQ, but those in special schools were significantly delayed in their achievement. The authors speculated that one reason for the latter finding might be that these children had more severe physical handicaps than the former group; however, the relation between specific handicaps and delayed achievement was not tested.

Clearly a study is needed to examine the relationship between specific intellectual deficits and academic achievement. Knowledge of the relationship between general IQ and achievement is of limited usefulness because specific difficulties in perceptual-performance abilities i and attention may furtner inhibit learning. As Diller (1969) has noted:

> There appears to be a disassociation of abilities in the SBH (spina bifida with hydrocephalus)children so that even in instances in which they achieve the same scores on tasks as other children, it may be through the use of different abilities. Hence, teachers might be drawing the wrong conclusions about the child's mental functioning if they assume competence in one ability from competence in another.

The present study was designed to examine the following questions:

1)What are the relationships among measures of intelligence, socioeconomic status, distractibility, hydrocephalus and lesion level, and measures of achievement?

2) Which of the above measures best predict the failure of spina bifida children to achieve in school?

Method

Thirty-eight children with spina bifida and hydrocephalus were tested on a Wechsler Intelligence test and the WRAT. Characteristics of the sample are given in Table 1. Socioeconomic status was scored based on the occupation of the head of household following Reiss (1961). Verbal, performance, and freedom from distractibility quotients were computed based on the methods of Cohen (1959). Information on the presence of hydrocephalus and level of lesion at birth were obtained from medical records.

Results

Coefficients of correlation are shown in Table 2 between the predictors and achievement. These correlations indicate that socioeconomic status, verbal and performance IQ, and freedom from distractibility are all related to achievement.

TABLE 1

SAMPLE CHARACTERISTICS

SOCIOECONOMIC STATUS (BASED ON OCCUPATION OF HEAD OF HOUSEHOLD)

0-1	UNEMPLOYED OR LABORERS- HEAVY MANUFACTURING	10.5%
2-3	LABORERS, PERSONAL SERVICE, EQUIPMENT OPERATORS	26.5%
4-5	SKILLED OPERATIVES, CRAFTSMEN, CLERICAL	42.0%
6-7	SELF-EMPLOYED PROPRIETORS, SALARIED MANAGERS, LOW-LEVEL PROFESSIONALS	20.0%

AGE OF SUBJECTS

6.5 - 8.5	26%	
8.5 -10.0	27%	$\bar{x}$ = 10.17 YEARS
10 -12	29%	SD= 2.3 YEARS
12 -15	18%	

HYDROCEPHALUS	87%

LESION LEVEL

CERVICAL	5.3%
CERVICOTHORACIC	0 %
THORACIC	21 %
LUMBARTHORACIC	13 %
LUMBAR	52.6%
LUMBERSACRAL	2.6%
SACRAL	5.3%

RACE	WHITE	84%
	BLACK	13%
	OTHER	3%
SEX	FEMALE	60%
	MALE	39%

STUDY VARIABLES

TABLE 1 (cont'd)

		RANGE		
VERBAL IQ		44-131	x=78	SD=18.58
PERFORMANCE IQ		39-121	x=71	SD=20.40
FREEDOM FROM DISTRACTIBILITY		41-115	x=72	SD=19.00
MATH	STANDARD SCORE	46-108	x=78.5	SD=15.9
READING	STANDARD SCORE	50-139	x=88.7	SD=21.00
SPELLING	STANDARD SCORE	39-138	x=84.8	SD=21.6

TABLE 2

1) WHAT ARE THE BIOLOGICAL, SOCIAL, INTELLECTUAL, AND ATTENTIONAL CORRELATES OF ACADEMIC ACHIEVEMENT IN SPINA BIFIDA CHILDREN?

WRAT STANDARD SCORES

	MATH	READING	SPELLING
VERBAL IQ	.76	.63	.58
PERFORMANCE IQ	.64	.53	.55
FREEDOM FROM DISTRACTIBILITY	.70	.55	.59
HYDROCEPHALUS	.23	.13	.14
LESION LEVEL	.02	.10	.30
SOCIOECONOMIC STATUS	.41	.62	.38

CORRELATIONS INDICATE THAT SES&INTELLECTUAL MEASURES ARE ALL RELATED ACHIEVEMENT. BIOLOGICAL VARIABLES HAVE A WEAK RELATION.

TABLE 3

2) WHICH FACTORS BEST PREDICT ACHIEVEMENT, WHEN SOCIOECONOMIC STATUS IS CONTROLLED?

PREDICTING MATH ACHIEVEMENT

VARIABLE	MULT.R	R^2	R SQ CHANGE	BETA	
SES	.41	.17	.17	.09	
VERBAL IQ	.76	.58	.42	.32	
PERFORMANCE IQ	.78	.60	.01	.31	
LESION LEVEL	.79	.63	.03	-.23	
FREEDOM FROM DIST.	.80	.64	.01	.23	DF=5,26 F=9.4

PREDICTING SPELLING ACHIEVEMENT

SES	.38	.14	.14	.30	
PERFORMANCE IQ	.64	.40	.26	.19	
LESION LEVEL	.66	.44	.04	.24	
FREEDOM FROM DIST	.68	.47	.03	.23	DF=4,27 F=5.94

PREDICTING READING RECOGNITION

SES	.62	.39	.39	.55	
PERFORMANCE IQ	.77	.59	.21	.35	
					DF=2,29 F=21.22

THESE RESULTS INDICATE THAT, WHEN SOCIOECONOMIC STATUS IS CONTROLLED, PERFORMANCE IQ IS CONSISTENTLY RELATED TO ACHIEVEMENT. FREEDOM FROM DISTRACTIBILITY AND THE LEVEL OF LESION ARE GENERALLY RELATED. VERBAL IQ ONLY PREDICTS MATH ACHIEVEMENT. THIS LATTER RESULT MAY BE DUE TO THE HIGH CORRELATION BETWEEN VERBAL IQ AND SOCIOECONOMIC STATUS.

Biological variables have a weak relationship to achievement. This correlation pattern between IQ scores and achievement differs from those of normal children, who frequently show a weak relation between performance IQ and achievement.

Separate step-wise multiple regression analyses, regressing math, spelling and reading achievement on the four categories of predictors were conducted with Socioeconomic status entered first, because of its strong relationship to intelligence. Results are shown in Table 3. These results indicate that, when socioeconomic status is controlled, performance IQ is consistently predicts achievement. Freedom from distractibility, and the level of lesion are predictive of math and spelling. Verbal IQ only predicted math achievement. This latter result may be due primarily to the fact that SES was entered first into the equation, and this variable may have had overlapping variance with verbal IQ.

Discussion

Results suggest that delays in achievement are significantly related to specific intellectual strengths and weaknesses, as well as socioeconomic status. The strong relationship of performance IQ to all measures of achievement indicates that delayed development in this area greatly restricts learning. Delays in perceptual-performance abilities in spina bifida children are well-known, but their consistent contributions to achievement have not been well documented. These results indicate that efforts should be made to give these children intensive experiences in perceptual-motor learning prior to entering school, so that their learning can be optimized.

The finding that verbal IQ only predicted math achievement appeared to be due to the strong correlation between verbal IQ and SES, the latter of which was always entered first into the prediction. This explanation is partially supported by the finding that, when multiple regressions were conducted without SES, verbal IQ was also predictive of reading but not spelling.

The relatively low contribution of biological variables such as hydrocephalus and lesion level may be due to two converging factors. First, a great majority of the sample had hydrocephalus, and hence little variability existed on this variable. Second, in this sample, lesion level was correlated with performance IQ, and hence, may hot have entered into the reqression equation because of the overlapping variance with this IQ measure.

These results indicate that assessment of children with spina bifida should include examination of intellectual strengths and weaknesses, and educational programming should take advantage of those strategies that these children have available for learning, while remediating those that are delayed. Competence or weakness in one area cannot provide the basis for assuming a level of ability in another cognitive area.

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Paper presented at the Annual Meeting of the
American Psychological Association
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